Computer Science-Academic - APR
Self-Study Report by Academic
Unit/Department
Generated: 3/15/22, 3:09 PM

Program Mission

Computer Science Mission

Program Mission Statement:

To train computer scientists with the skills, knowledge, and perspective to benefit society.

Program Goal (add a minimum of 3 program goal "plan items")

Goal 2- Increased Curricular Offerings

Goal Statement:

Expand curricular offerings to better serve the UI and Idaho community.

Alignment to UI Strategic Plan Goals: Transform (Goal 3): Increase our educational impact.

Indicators/Metrics to Evaluate Progress:

Submission of several new program proposals.

List of Actions the Program Will Take to Achieve Goals :

Submit for review: minor in Cybersecurity, PhD in Cybersecurity, Certificate in Robotics, a high school award for completing dual credit courses.

Goal Achievement Level:

Goal 1 - Improved Retention

Goal Statement:

Improve the rate of retention for our undergraduates.

Alignment to UI Strategic Plan Goals: None

Indicators/Metrics to Evaluate Progress:

Overall retention rate.

List of Actions the Program Will Take to Achieve Goals :

Continuing review of our courses to identify the where we are losing the most students. Student interviews and surveys to identify why we are losing students.

Goal Achievement Level:

Goal 3 - Increased Online Academic Presence

Goal Statement:

Increase the availablilty and quality of CS courses to remote students.

Alignment to UI Strategic Plan Goals: Transform (Goal 3): Increase our educational impact.

Indicators/Metrics to Evaluate Progress:

Number of CS courses available remotely (EO, virtual meeting, on-line, etc.). Number of students participating in remotely available sections of CS courses. Feedback from students (course evaluations, surveys, exit interviews, etc.) regarding the quality of the remote course experience.

List of Actions the Program Will Take to Achieve Goals :

Work with the university to develop standard methodology to offer remote courses.

Goal Achievement Level:

Goal 4 - Program Assessment

Goal Statement:

Develop processes to leverage UI's new internal dashboards to consistently track student persistence, retention, and completion; and access to senior survey data to refine the program. Develop processes to assess certificate programs.

Alignment to UI Strategic Plan Goals: Transform (Goal 3): Increase our educational impact.

Indicators/Metrics to Evaluate Progress:

We will use UI dashboard data on persistence, retention, and completion, and UI senior surveys, to evaluate our progress on this goal.

List of Actions the Program Will Take to Achieve Goals :

1. Review with the faculty what data is available to them and how to access it.
2. Assign faculty to review specific areas of the data and report to the department.
3. Discuss, as a department, potential changes to improve our performance.
4. Implement suggested changes.
5. Evaluate impact of those changes.

Goal Achievement Level:

Student Learning Assessment Report (add one "plan item" for each major, degree, and/or certificate offered by dept)

Computer Science BS

Assessment Report Contact: Terence Soule

Program Changes in Past Year:

CS360 Database Systems added as a required course

CS220 Secure Coding and Testing added as a required course

List of allowed science courses expanded

Stat251 accepted as an alternative to Stat301

CS360 Database Systems extended from 3 to 4 credits

Learning Outcomes are Communicated to All Students in Program (check box if true): true

Learning Outcomes are Communicated to All Faculty (check box if true): true

Optional: Framework Alignment:

Import Outcomes Data (from Anthology Outcomes):

1

Learn and Integrate

Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.

Academic Year 2019-2020: Computer Science-Academic

Term: Overview

No Results

2

Think and Create

Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.

Academic Year 2019-2020: Computer Science-Academic

Term: Overview

No Results

3

Communicate

Communicate effectively in a variety of professional contexts.

Academic Year 2019-2020: Computer Science-Academic

Term: Overview

No Results

4

Practice Citizenship

Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.

Academic Year 2019-2020: Computer Science-Academic

Term: Overview

No Results

5

Communicate

Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline

Academic Year 2019-2020: Computer Science-Academic

Term: **Overview**

No Results

| 6 |

Think and Create; Clarify Purpose and Prospective

Apply computer science theory and software development fundamentals to produce computing-based solutions.

Academic Year 2019-2020: **Computer Science-Academic**

Term: **Overview**

No Results

Summary of Student Learning:

Overall students are meeting the learning outcomes. This conclusion is supported by both the direct and indirect measures. There are a few weak points (see imported outcomes data) that need to be addressed through our continual improvement processes. Because assessment of outcomes is done in the 300- and 400- level courses, these weaknesses are discussed by all faculty so that they can be addressed throughout the curriculum.

Summary of Faculty Discussion:

Faculty felt that programming skills were not as strong as they could/should be by the senior years -- due in part to a reduced amount of programming in the sophomore and junior years. Additionally, some skills that were important in the junior/senior years were not fully developed.

Summary of Changes/Improvements Being Considered:

CS 220 was added as a required course to increase programming practice in the sophomore year. CS 360 was expanded to 4 credits to increase programming and hands-on experience in the junior year. The content of CS 210 Programming Languages was changed slightly to make sure that it covers the skills needed in the junior and senior years.

Inter-rater Reliability:

We use a standardized document for data collection to try to ensure that all faculty are using similar metrics and instruments for assessing student mastery of program learning outcomes.

Closing the Loop:

Previous assessments have led to a number of program changes in terms of both curriculum (required courses) and teaching methodology (an increased use of supplemental materials, allowing more hands-on, flipped classroom, style activities in the classroom). Student performance in program 'capstone' courses, including both Senior Capstone Design (CS480/481) and Compilers (CS 445) has improved slightly and is in on track to meet our goals given that some of the changes (e.g. additional credits in CS 360 and making CYB 220 required) have not impact out current seniors.

Attached Files
📄 CS-E002-EAC-Self-Study-Questionnaire-08-29-18 V13.docx

Cybersecurity BS

Assessment Report Contact: Terence Soule

Program Changes in Past Year:

The BS in Cybersecurity is brand new as of Fall 2020. No changes to the program have been made in the year since its inception.

Learning Outcomes are Communicated to All Students in Program (check box if true): true

Learning Outcomes are Communicated to All Faculty (check box if true): true

Optional: Framework Alignment: ABET and CAE

Import Outcomes Data (from Anthology Outcomes):

Students in the program are only completing their first year. Assessment of the program learning outcomes takes place in the junior and senior years, as such there is no formal assessment data available at this time. Informally, there has been significant student interest in the program (it currently has ~45 majors) and feedback on the courses has been very positive.

Summary of Student Learning:

As noted above data is collected in the upper division course to determine whether students are meeting learning outcomes for the program. Because the program is only one year old no students have taken the upper division courses (they are primarily freshmen or sophomores who changed majors) so no data is currently available.

Summary of Faculty Discussion:

We have discussed the progress in the first year. Student interest in the program is very high, as noted by the number of majors, and feed back on the courses taught to date has been positive. Faculty are very please with the progress of the program and how it complements the previously existing programs.

Summary of Changes/Improvements Being Considered:

No changes are being considered at this time.

Inter-rater Reliability:

Following the model for the CS BS program we use a standardized document for data collection to try to ensure that all faculty are using similar metrics and instruments for assessing student mastery of program learning outcomes.

Closing the Loop:

There have been no past assessment efforts of the program as this is its first year.

Student Achievement

Student Achievement

Student Retention:

Student retention is tracked by comparing freshman classes to number of graduating seniors 4 years later. That is we primarily track completion. This approach has some weaknesses. Many students take more than 4 years to graduate. However, they still represent 'successful' graduations, but compared to a different freshman class, so the impact is relatively small. Some students come in as transfers and are not counted in a freshman class, which leads to a slightly boosted retention rate. We do not currently disaggregate data.

Student Persistence:

Student persistence is tracked using the University's internal dashboards.

Student Completion:

Student completion using UI's internal dashboards, which supplies a 6 years graduation rate. The figure below shows completion rates in the major, not from the University. A percentage of CS majors change majors and successfully complete from that new program. (Computer Engineering, Electrical Engineering, Virtual Technology Design, and Business/IT are common alternative majors.)
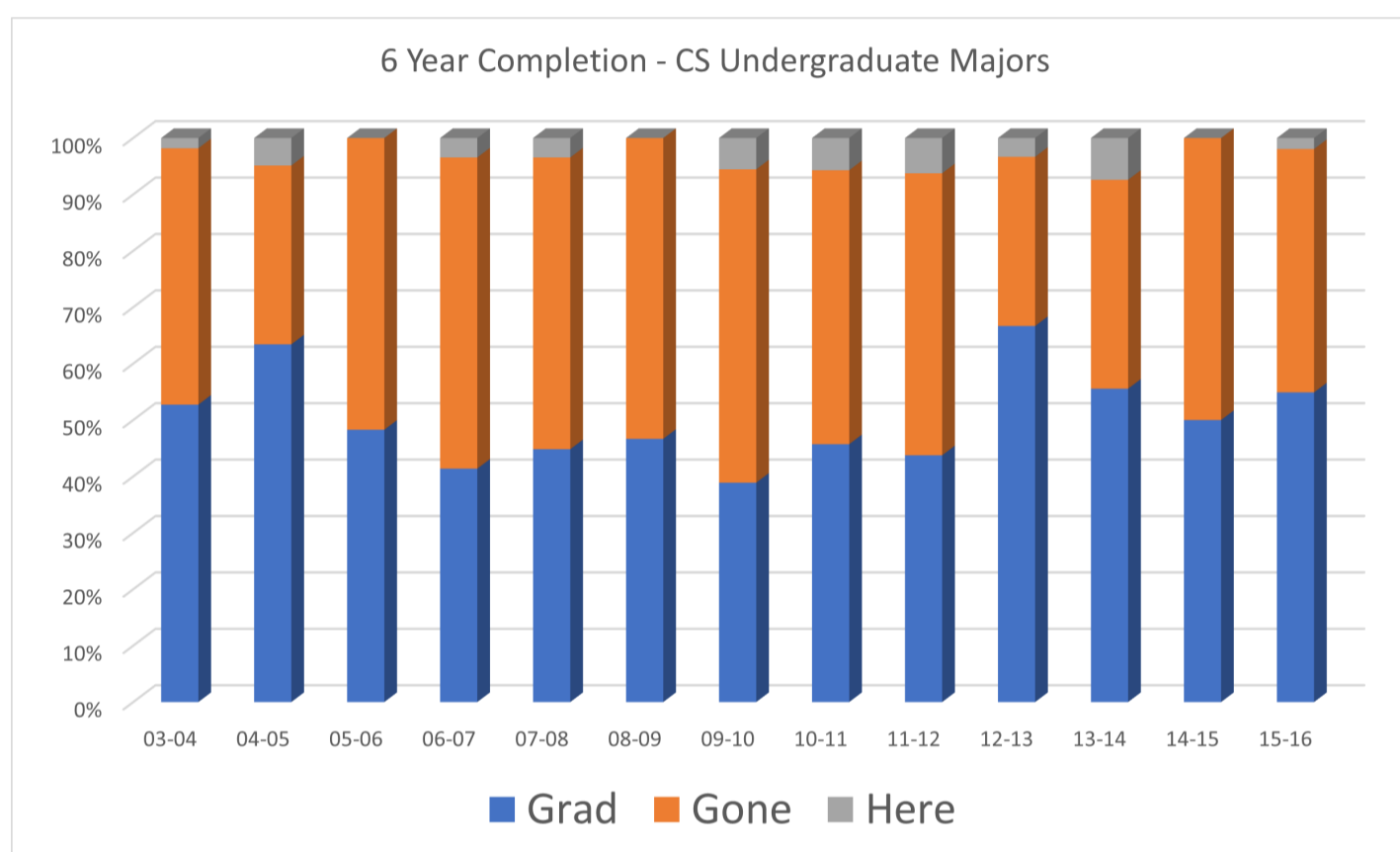
There appears to be a positive shift from ~40% completion to ~50% completion starting with the Freshman class of starting in 12-13.

Data by gender is similar, typically 50% completion rates for self-identified females, but overall numbers are very low.

Completion rates for first generation students were noticably lower up to the Freshman class of starting in 12-13, and then followed the general trend.

There is insufficient data to disaggregate by race.

Student Postgraduate Success:

Postgraduate success data comes from several sources: the graduating senior survey, graduation exit interviews, College surveys, and the alumni office's data.

Identify Equity Gaps:

The figure below shows data on equity gaps for all CS and Cybersecurity undergraduates. By race there appears to be a significant gap with non-white, non-Asian students having significantly poorer GPAs. However, the number of students in these categories is so small (1-3) that is it not clear that the GPA gap is accurate. This does mean that there is a significant gap in recruitment that needs to be addressed.

With respect to gender there is no GPA gap (women perform slightly better than men). However, as with non-whites the enrollment data is poor. For 2021 the percent female undergraduates was ~17.8% (for 2020 it was ~15.3%). Notably, this is a significant improvement from the past, in 2012 it was ~7.8% and in 2013 it was ~11.4%. So, the enrollment trend is positive.

APR Computer Science

UG GPA by Race (Fall 2021)

| Race/Ethnicity by Measures	Avg UG Cum GPA	Avg UG Incoming GPA	Average ACT Score	Average SAT Score
White	3.17	3.36	26.74	1,193.03
Asian	3.05	3.31	24.5	1,270
American Indian or Alaska Native	2.45	2.81	19.88	0
Black or African American	2.68	2.59	17.86	860

GRAD GPA by Race (Fall 2021)

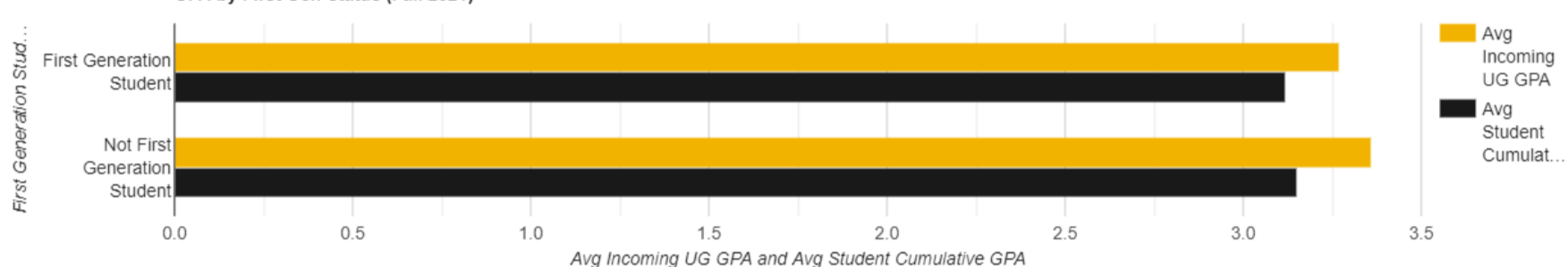| Race/Ethnicity by Measures	Avg GRAD Cum GPA	Avg GRAD HS Incoming GPA	Average ACT Score	Average SAT Score
White	3.33	3.46	27.29	1,212
Asian	3.79	1.92	0	0
American Indian or Alaska Native	3.6	4	28	0
Black or African American	3.45	0	0	0

GPA by Gender (Fall 2021)
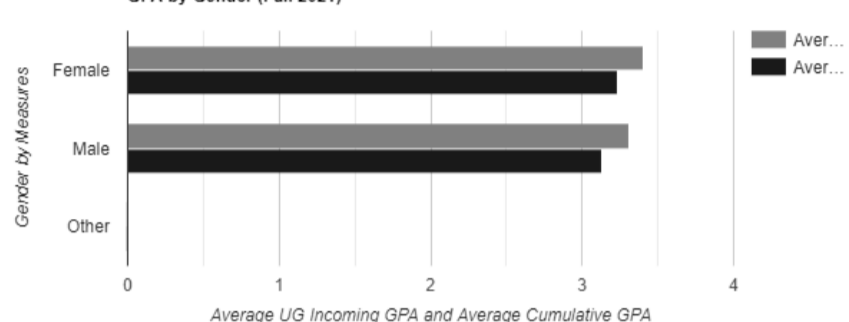
GPA by College (Fall 2021)
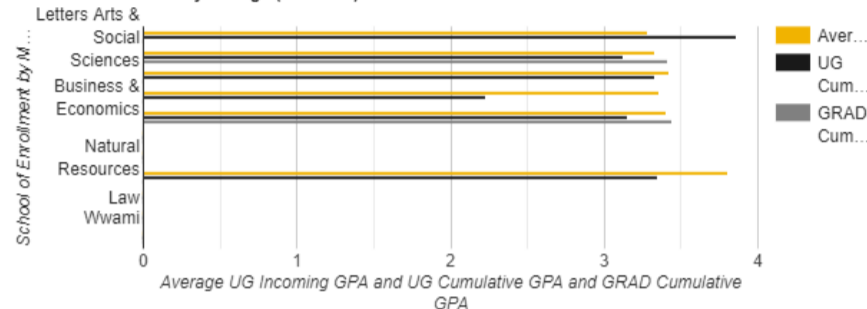
GPA by First Gen Status (Fall 2021)

Effective Learning Environment and Closing Equity Gaps:

As noted above there doesn't appear to be significant equity gaps with regards to GPA for students in the program. However, there are significant gaps in enrollment. We have taken several steps to address the gender gap. We have developed middle school programming camps that target females to help create a pipeline of students. We have tried to adjust our recruitment activities to have a wider appeal, with more focus on the potential social impact of the computing disciplines. We have worked to make the environment for current students more inclusive to avoid equity gaps in retention. There is reasonable evidence that these efforts are 'moving the needle' on the gender gap in enrollment. Addressing the equity gap by race is the next step.

Demand and Productivity

New Demand and Productivity Item

External Demand:

The attached graph shows total undergraduate enrollment (CS and Cybersecurity) primary majors only. There are approximately another 30 students whose primary major is not within CS (CS or Cybersecurity) whose secondary major is either CS or Cybersecurity. We had steady growth from 2012 through 2018. In 2019 and 2020 we had a small decline in the number of majors. This correlates with a nationwide trend in decreasing engineering majors and is possibly related to the rapid expansion of the BSU CS program, which was accompanied by significant advertising in those years, which UI did not match.

In 2021 we saw a significant growth (47 students, ~21%) in the undergraduate population. Most of this was in the new Cybersecurity BS program (37 students), but is also included health growth (10 students, ~5%) in the Computer Science BS.

Attached Files
📄 Totalundergrads.png

Internal Demand:

Credit hour production (SCH by term) has increased steadily and significantly. See figure below.
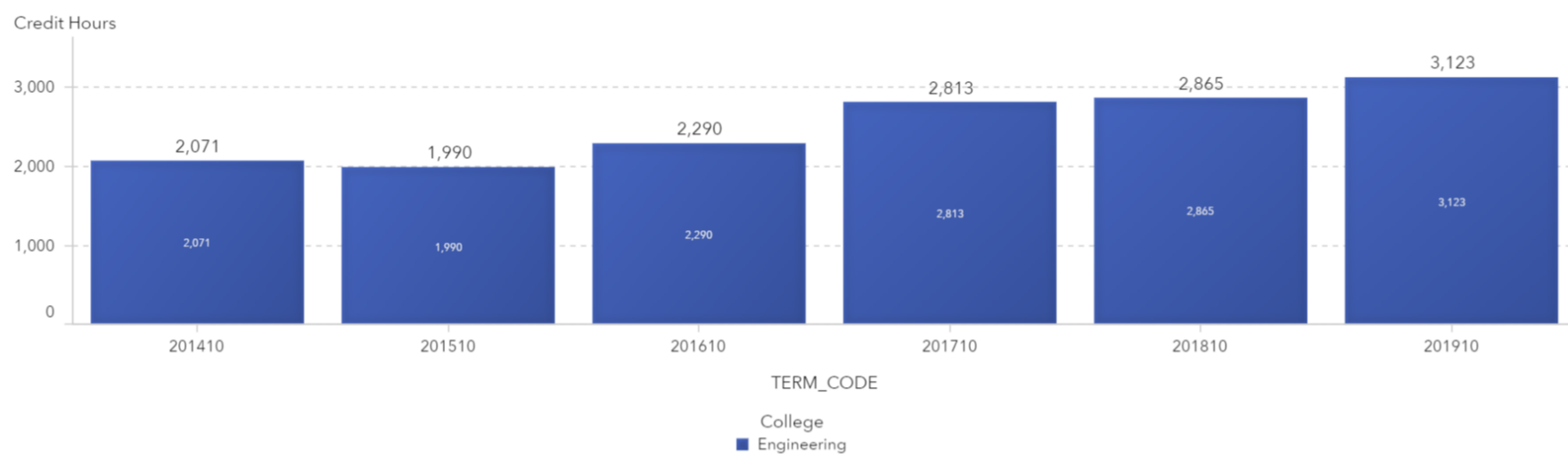
This reflects the growing demand for CS courses and content across a wide range of disciplines.

Credit Productivity:

The CS department's major strengths are the rapidly growing interest and demand for CS and Cybersecurity as a primary major, minor, and as supplemental knowledge. This strength is reflected in our growth in both enrollment and credit productivity. Our major weakness is a lack of support for continued growth.

The major opportunity for CS is in continued growth in both primary majors, minors, and in services classes for fields that are requiring increasingly advanced computer skills.

There is one major threat and one mixed blessing.

Major threat: Lack of support. Currently we have **276 undergraduate majors and 52 graduate students** on the Moscow campus. Supported by **8 faculty** (there are 9 faculty in Moscow, but one is on leave, which given sabbaticals every 7 years per faculty is typical) and **one** staff member on the Moscow campus. That is an **undergraduate student-faculty ratio of 34.5 in Moscow**, which is unsustainable in engineering and only manageable because faculty on remote campuses (4 in CdA, one on sabbatical and 4 in IF) partially alleviate the teaching load. There is no undergraduate program in IF so those faculty only teach 400/500 level courses. The CdA program only covers the 3rd, and 4th years of the undergraduate program (it supports transfer students from NIC and other area community colleges) and graduate programs so those faculty rarely teach 100 or 200 level courses and, being remote, have difficulty supporting large Moscow sections.

The graduate student-faculty ratio in Moscow is 6.5. That is reasonable for graduate students, but doesn't allow us to take advantage of growth opportunities.

Overall, we are at the breaking point. We are currently relying on adjunct faculty for some courses, don't have the faculty to add the last two years of the Cybersecurity bachelors, and if we have a faculty retire or leave we may not be able to offer the CS bachelor's degree in full.

Mixed blessing: Out of department CS courses. As the need for computing skills grows in many majors, departments are creating their own computing courses. This keeps the burden on the CS faculty from growing, but leads to significant inefficiencies for the university. For example, there are currently at least 3 undergraduate Python courses across campus.

Financial Health and Resources

New Financial Health and Resources Item

Financial Health:

The financial health of the department is sickly at best. On the Moscow campus we have we have **276 undergraduate majors and 52 graduate students** supported by **8 faculty** (there are 9 faculty in Moscow, but one is on leave, which given sabbaticals every 7 years per faculty is typical) and **one** staff member. The non-salary portion of our operating budget is $18,700, this is sufficient to cover basic operating expenses: office supplies, replacement office equipment, replacement computers, hosting IAB meetings, supporting travel between branch campuses, etc.. But this does not allow for any new initiatives to pursue expansion or growth (recruitment activities, research opportunities, etc.).

Staff resources are an even larger concern. Although there is some additional staff support in the College's IT and financial staff this support is limited to 'regular' activities: maintaining existing computer systems, filing standard financial documents, and is encumbered by ticketing and on-line processes that only support 'regular' activities. But there is only one staff member in Moscow dedicated to supporting over 300 and students and 8 faculty (there is a second CS staff person in CdA, and no dedicated CS staff in IF at all).

This means that faculty are burdened with routine tasks that could be more efficiently handled by well-trained staff. And, more importantly, there is no bandwidth for pursuing new initiatives and opportunities.

Efficient Use of Resources:

Our student-faculty, student-staff, and student-operating expenses ratios all look very positive for an engineering program. However, I would not characterize our current use of resources as particularly efficient. Faculty are doing tasks that could be more efficiently done by staff. Opportunities for growth are being missed because there are no resources (time or money) to invest.